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TRANSPLANTING SHADE TREES.
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THIS RESOURCE MATERIAL FOR USE IN HIGH SCHOOL VOCATIONAL AGRICULTURE AND ADULT FARMER CLASSES WAS DESIGNED BY SUBJECT MATTER SPECIALISTS, TEACHER EDUCATORS, SUPERVISORS, AND TEACHERS. THE OBJECTIVE IS TO HELP SOLVE PROBLEMS IN TRANSPLANTING SHADE TREES. THE MAJOR SECTION TITLES ARE STATED AS PROBLEMS -- (1) HOW SHOULD I PREPARE A TREE FOR MOVING, (2) HOW SHOULD I PLANT A TREE, AND (3) HOW SHOULD I PROTECT THE TREE. THE MATERIAL MAY BE USED AS EITHER A TEXT OR A REFERENCE ASSIGNMENT FOR A UNIT REQUIRING 1 TO 4 HOURS. TEACHERS SHOULD HAVE GENERAL COMPETENCY IN AGRICULTURE, AND STUDENTS SHOULD BE OF AVERAGE ABILITY AND HAVE INTEREST IN AGRICULTURE AND ORNAMENTAL HORTICULTURE. THE DOCUMENT IS PRINTED ON HIGH QUALITY PAPER AND ILLUSTRATED WITH PHOTOGRAPHS AND DRAWINGS. THIS DOCUMENT IS AVAILABLE FOR 15 CENTS FROM VOCATIONAL AGRICULTURE SERVICE, 434 MUMFORD HALL, UNIVERSITY OF ILLINOIS, URBANA, ILLINOIS 61801. (JM)

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TRANSPLANTING SHADE TREES

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1. How Should I Prepare a Tree for Moving?
2. How Should I Plant a Tree?
3. How Should I Protect the Tree?

1. HOW SHOULD I PREPARE A TREE FOR MOVING?

Careful attention to recommended practices—including predigging preparations, methods of digging, and protection of roots—is good insurance for your success in getting a tree off to a good start after it is moved.

Tying-in branches, marking orientation

Tying-in the branches of low-branched or bushy plants will help avoid injury and facilitate digging. Heavy twine is usually used for tying-in branches, but burlap strips or 1/4-inch rope may also be used. To tie-in the branches, attach the twine or other suitable material to a branch at the base of the tree and then wind it spirally around the plant to the top and tie it in a loop (Fig. 1).

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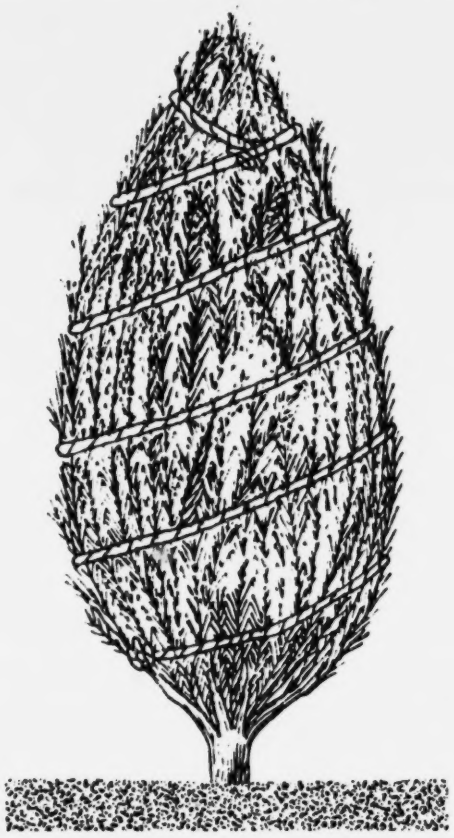

Fig. 1. To prevent unnecessary injury, tie-in with rope or strips of burlap.

Before digging the tree, mark a branch that faces north (or any other direction) so the tree can be properly reoriented when planted.

Digging the tree

After the branches are tied-in, the tree is ready for digging. Deciduous trees under 2 1/2 to 3 inches in trunk diameter, measured 1 foot above the ground, are usually moved with bare roots. "Bare root" means that most or all of the soil is removed from the roots when the tree is dug. Thus, a tree can be dug with a larger root system than if it is taken with a ball of soil.

The digging operation consists of trenching around the tree and removing the soil from around the roots. Dig the trench far enough from the tree to preserve a large proportion of the fibrous roots. This distance is usually 6 inches for each inch of diameter of the trunk. Thus, for a tree with a 3-inch trunk, the trench would be 18 inches from the trunk. Make the trench deep enough to extend below the level of the lateral roots; the depth may vary from 12 to 18 inches (Fig. 2).

After digging the trench, remove the soil from around the roots. It may be shaken off if the tree is small or it can be loosened and combed out of the fibrous roots with a spading fork. Special care is required to keep root injury to a minimum. This is accomplished by working inward from the trench with the spading fork. Greater root protection is obtained if the tree is moved with "semibare" roots—some soil is left clinging to the fibrous roots. This added protection will help the tree recover more rapidly.

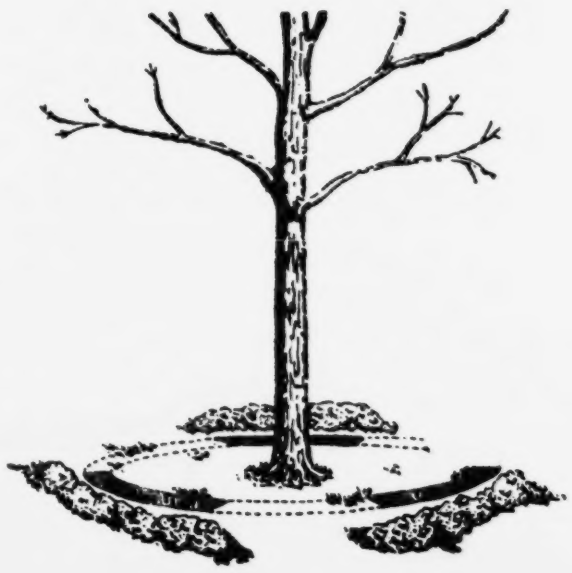

Fig. 2. Dig the trench deep enough to extend below the main lateral roots and far enough from the tree to preserve a large proportion of the fibrous roots (courtesy National Park Service).

After the lateral roots are free of soil, tip the tree to remove the soil from under the plant. Tip the tree very gradually to avoid straining or breaking the roots and loosening the bark near the base of the trunk. Cut any anchor roots or tap roots that still hold at a depth of 14 to 18 inches. To lift the tree out of the hole, grasp it at the junction of the roots and trunk. Pack the exposed roots in some moisture-holding material, such as straw, sphagnum, peat moss, sawdust, shingle tow, or wood chips, and wrap in burlap to protect against drying and mechanical injury (Fig. 3).

"Balled and burlapped" means that the soil is not removed from the roots when the tree is dug. This is referred to as a B&B tree by the nursery trade. Deciduous trees 2 1/2 to 3 inches and larger in trunk diameter, measured 1 foot above the ground, and evergreens are usually moved and planted with balls of soil covering their roots. The size of the ball will depend on the size and species of the tree and the type of soil in which the tree is growing. Trees that are difficult to move, such as beech, hickory, hornbeam, sassafras, sweet gum, tupelo, walnut, and white oak, need larger balls than trees that are easy to move. Trees growing in loose, well-drained soil, such as a sandy soil, will have more extensive or spreading root systems than trees growing in a hard, poorly drained soil like a tight clay.

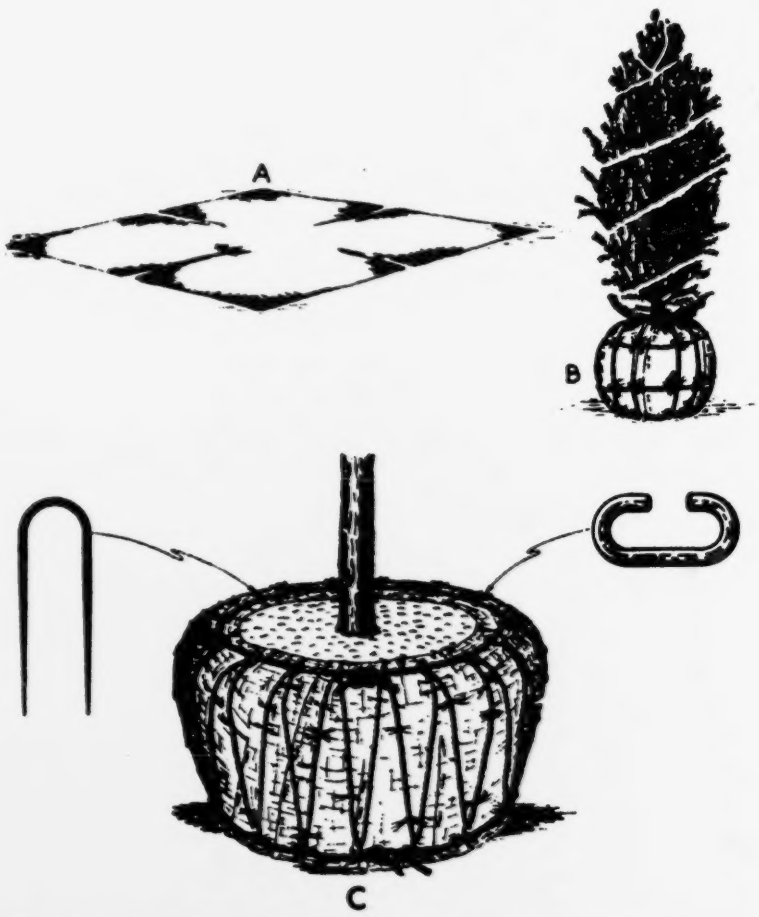

Fig. 3. Trees can be "balled and burlapped" for transplanting. (A) Burlap cut for wrapping small tree, (B) Small evergreen properly wrapped, and (C) Strips of burlap are used on larger trees (courtesy National Park Service).

In general a ball for deciduous trees is approximately 10 inches in diameter for each inch of trunk diameter 1 foot above ground. Therefore, a tree with a trunk 3 inches in diameter needs a ball 30 inches in diameter. If a ball is too large, the roots will be inadequate to hold the soil together and the ball may break apart when the tree is moved.

The ball of soil for evergreens is determined by the height of the plant rather than by the diameter of the trunk. Evergreens 1 1/2 to 2 feet high need a ball 12 inches in diameter. For each additional foot in height, up to 10 feet, the ball diameter is increased 2 inches. For each additional foot in height above 10 feet the diameter is increased 1 1/2 inches.

Before digging is started, remove any loose soil above the roots. Then make a circle around the plant approximately 6 inches beyond the anticipated diameter of the finished ball. Cut the roots to a depth of approximately

12 inches by inserting a spade at the marked circle with the back side of the spade toward the tree. Using a sharp spade will result in clean cuts which heal rapidly. Next, dig a trench outside and adjacent to the marked circle and about three-fourths the desired depth of the ball, which is usually 10 to 16 inches.

Trim the ball to proper size and shape with the spade, keeping the back side of the spade toward the tree. Round off the trimmed ball at the top edge and taper it inward toward the base (Fig. 4). Avoid loosening the soil

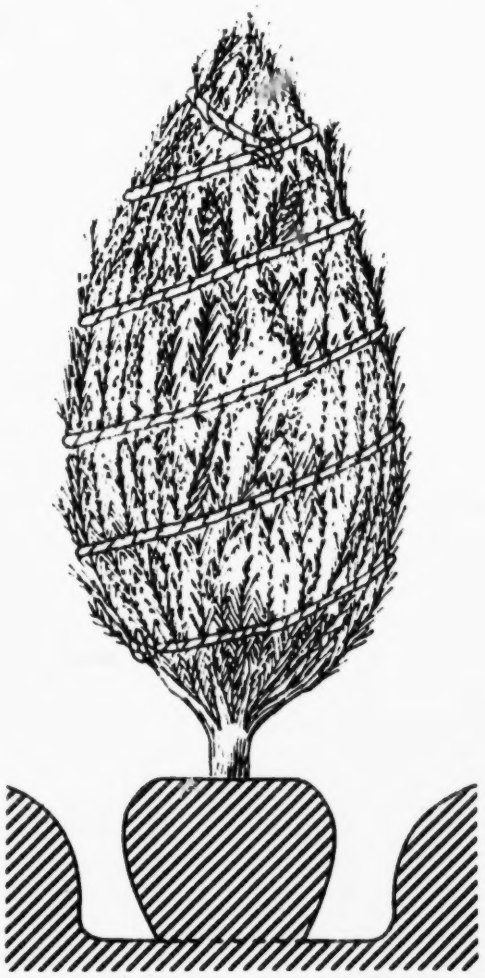

Fig. 4. Dig the trench approximately three-fourths of the desired depth of the ball, then under-cut and trim it to proper shape.

around the roots by cutting small roots with a sharp spade and large roots with hand or lopping shears. Next, undercut the ball of soil at an angle of about 45 degrees to sever any remaining roots and to loosen the ball from the soil beneath.

To prevent drying, cracking, and crumbling of soil wrap the ball tightly with burlap. Balls up to 15 inches in diameter can be completely covered with burlap. One method is to tip the ball and place a piece of rolled burlap under half of the ball. Then tip the ball in the opposite direction and pull the burlap under the other half. Pull the burlap up around the ball and tie the diagonal corners at the top. Wrap loose folds of burlap tightly around the ball and pin the burlap in place with sixpenny or eightpenny balling nails.

Balls of soil are heavy and difficult to move. A ball of soil 15 inches in diameter and 15 inches deep may weigh 200 pounds or more, and one 24 inches in diameter and 18 inches deep will weigh over 400 pounds. A tree with a small ball of soil can be lifted out of the hole with two spades inserted under the ball from opposite sides, or by placing a piece of burlap under the ball and lifting while grasping the four corners of the burlap. Balls of soil weighing several hundred pounds must be handled carefully to avoid injury to the roots. They should be prepared and moved by arborists, nurserymen, or other persons familiar with the procedures of digging, burlapping, rope lacing, and moving such large balls.

Transporting the tree

One or several small trees obtained from a nursery or woodland are frequently transported by car or truck. Trees ordered from distant nurseries are usually sent by freight and shipped by train or truck. Large trees, especially those with soil balls weighing several hundred pounds, are transported by special types of trailers or automotive equipment. This specialized equipment is used by nurserymen, arborists, and other commercial operators engaged in moving large trees.

Protecting the roots

The roots should never be allowed to dry from the time the tree is dug until it is planted in the new location. Prolonged exposure to air will cause the roots to dry out and die. Roots can be protected by packing them in moist straw, sphagnum, peat moss, sawdust, shingle tow, or other suitable material and then wrapping with burlap.

If your trees are delivered without balls of soil, plant them immediately or heel them in to prevent drying of the roots. Heeling-in consists of digging a trench wide and deep enough to accommodate the roots without crowding. A place with well-drained, sandy, or sandy-loam soil, and where the trees are protected from the sun and wind, is desirable. It is generally best to have the trench running east and west, and to place the trees so they lean toward the south or southwest. Throw the soil so that a bank will be formed against which the trees can lean. Remove the packing and spread the roots in the bottom of the trench. Cover the roots with fine, moist soil, tamp firmly, and then add enough additional soil to make sure the roots will not dry out.

If the trees are delivered with balls of soil, and are not planted immediately, the soil and roots must be protected from drying out. Cover the soil ball with canvas, or with one of the mulch materials suggested for protecting bare roots, and keep moist until the trees are planted.

2. HOW SHOULD I PLANT A TREE?

Location, methods of digging the hole, soil conditions, and several other considerations are in order when planting your tree.

Location

Before planting a tree, give careful consideration to where it will be located. This is important because the tree must thrive in the soil where it is planted and also give the desired shading or ornamental effects. For good tree growth and development, the most important requirement is a site that has fertile soil and adequate drainage. There are three general soil types: loam, clay, and sand. Loam soil in general is high in nutrients and has water, air, and temperature conditions suitable for good growth. Clay soil ordinarily is low in nutrients and does not drain well. Sandy soil does not hold adequate water, contains too much air, and is too low in nutrients for good plant growth.

The term "soil" usually refers to the fertile, upper layer, which is also called topsoil. Below this layer is the subsoil, which is frequently composed of clay or hardpan. Subsoil usually is wet, low in fertility, and relatively impervious to root growth. Often when houses and other buildings are constructed the subsoil is mixed with the topsoil. Avoid locating a tree in such a soil mixture, if possible, because it is not suitable for rapid growth.

Good drainage is necessary to allow adequate aeration for root growth and to provide the conditions required by beneficial soil organisms. Bacteria and other microorganisms which decompose the organic matter and aid in releasing plant nutrients cannot function properly in wet soil devoid of air. Roots of trees planted in poorly drained soil, such as a clay fill, may be submerged in water for long periods of time and suffocate because of lack of air. A tree that was killed because of inadequate drainage is illustrated in Fig. 5. However, trees planted in sandy soil must be supplied with adequate water or the roots will die from lack of moisture.

Trees should be planted far enough from buildings and other obstacles to allow for adequate sunshine, rain, air circulation, and room for normal growth and spread of branches. Trees planted too close to buildings grow lopsided and crowd the buildings (Fig. 6), frequently resulting in damage to both trees and buildings.

Planting procedures

Digging the hole. Dig the hole for a bare-root tree large enough so the roots can be fully expanded and arranged in their normal position (Fig. 7). They should not be twisted, crowded, or arranged in a circle against the

Fig. 5. Death of the red oak shown in this picture followed root suffocation caused by lack of soil drainage. The leaves turned brown and died before they were fully developed.

Fig. 6. Trees too close to buildings grow lopsided and their roots may damage the building foundation.

Fig. 7. In planting trees with bare roots, make the hole wide enough to allow 1 to 1½ feet of backfill beyond the tips of the roots. This illustrates a bare root tree properly transplanted.

wall of the hole or all in one direction. Fig. 8 shows the result of improper root arrangement, where the roots were twisted and pointed in one direction when the tree was planted.

Fig. 8. This twisted and lopsided root system resulted from improper planting. Such root systems frequently do not supply adequate nutrients and water for normal tree growth.

Improperly arranged roots may result in retarded growth or even death of entire trees after a few years. Balled trees need a hole 2 to 3 feet wider than the soil ball (Fig. 9). This allows for a trench 1 to 1 1/2 feet wide around the ball to be filled with good soil. The hole should be deep enough so the tree can be planted at the same depth as it was before it was dug. Some arborists prefer to set a tree slightly higher than it was in its original position. This allows for settling of the tree.

Fig. 9. Balled trees need a hole 2 to 3 feet wider than the soil ball.

Providing drainage. Adequate drainage is essential for the survival of newly planted trees, and any hole in soil that will not drain readily should have drainage provided. If clay or hardpan at the bottom of a hole is underlaid by gravel, you can provide adequate drainage with holes made by a soil auger or through fissures made by compressed air or dynamite. Fill holes made by a soil auger with gravel.

It is advisable to tile-drain holes for large trees. In clay soil, a single 3- or 4-inch standard agricultural tile drain across the bottom of the hole is adequate if the hole is not over 6 feet in diameter (Fig. 10). For larger

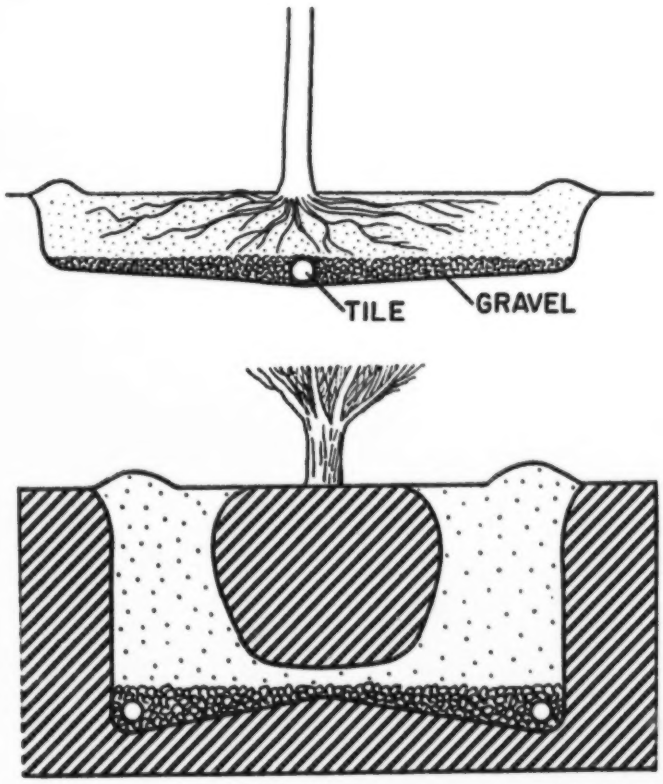

Fig. 10. Poorly drained soils may require additional drainage. Be sure to allow sufficient depth for the drain tile, gravel fill, and 2 to 3 inches of soil over the gravel before the tree is placed in the hole. The bottom of the hole should slant toward the tile.

holes and for evergreens, which in general require better drainage than deciduous trees, two lines of tile are recommended. The tile should lead to a suitable free outlet or, if such an outlet is not available, a dry well may be installed. A dry well (Fig. 11) is a large hole filled with gravel into which the water can flow. In some locations the drain tiles empty into a storm sewer. Never connect a drain to a sanitary sewer. Do not use crushed limestone in the bottom of the hole;

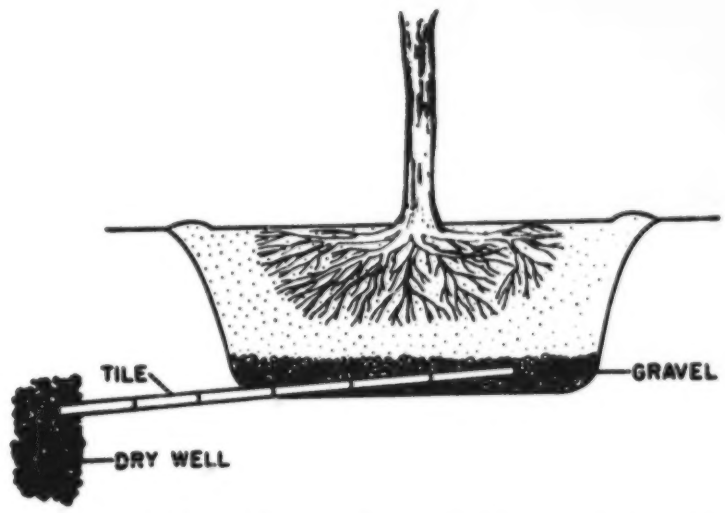

Fig. 11. A dry well or other suitable tile outlet may provide effective drainage in holes not over 6 feet in diameter. Use a single tile drain across the bottom and place enough gravel in the hole to cover the tile.

it tends to create an alkaline condition and cause a tree to develop chlorosis.

Improving soil fertility and texture. Heavy clay soil, low in nutrients, does not allow for adequate aeration and retains too much water for good root growth. Light, sandy soil is low in nutrients, allows for excessive aeration, and does not retain enough moisture for good root growth.

Poor quality soil can be improved in texture by adding peat moss, granulated sphagnum, well-rotted manure, or other suitable materials. Well-rotted manure supplies some nutrients. Usually it is not necessary to add commercial fertilizer until new root growth has developed. However, if the soil is low in nutrients you can improve it by adding superphosphate or commercial fertilizer high in superphosphate such as a 4-12-4 formulation. Five pounds of 20 percent superphosphate is recommended for each cubic yard of soil (3 3/4 ounces per bushel). The amount of commercial fertilizer to use varies from 3 pounds per cubic yard of soil (2 1/4 ounces per bushel) for small trees with bare roots to 10 pounds per cubic yard of soil (7 1/2 ounces per bushel) for large trees with balls of soil.

Breaking the ball. Delay in planting after a tree is dug may result in the formation of a

hard crust an inch or more deep at the surface of the ball of soil, especially if the soil is heavy clay. To assure a better moisture and air supply for good root growth, you can fork off or fracture the hard crust, or punch holes through it, before the backfill is added. A light surface application of a nonionized detergent (not over 1 ounce in 1 gallon of water) may help in initiating water penetration of the ball of soil that has a hard crust.

Placing the plant. Before placing the tree in the hole, put 2 or 3 inches of good loam soil in the bottom, or over any drainage material provided, including tile and gravel. To avoid air pockets under the soil ball, arrange the soil at the bottom of the hole so it is slightly higher in the center. If the tree was marked for proper orientation before it was dug, set it so that each side will have the same exposure or position that it had in its previous location. This is especially important in preventing sunscald or winter injury of bark on smooth- or thin-barked trees. If a tree cannot be properly oriented, you can protect its trunk and large branches by wrapping them with paper or burlap, or coating them with wax or latex.

Filling the hole. After placing the tree in the proper position, fill the hole with good loam soil. Bare-root trees need special attention. Work the soil in firmly around the roots as the hole is gradually filled. Gently raise and lower the tree slightly as the soil is added, to help eliminate air pockets around the roots. Add the soil in layers of about 6 inches, and tamp each layer to make it firm and to hold the tree perpendicular. Water may be used to settle the soil and to eliminate air pockets around the roots. If the soil is wet it should be tamped very little and the tree may not need "watering in." Spread a top layer of 1 to 2 inches of loose soil over the tamped soil to serve as a mulch. Leave a ridge or collar of soil at the margin of the hole (Fig. 12) to form a basin for holding water.

When planting a tree with a ball of soil, remove the burlap before filling the trench around the ball. Heavy burlap left around the ball of soil will reduce the amount of moisture reaching the roots. Also, the burlap may decay slowly and act as a barrier to normal root growth. However, if the soil in the ball is likely to crumble, the burlap can be slit along the sides with a sharp knife, rolled back from the top, and left on the ball.

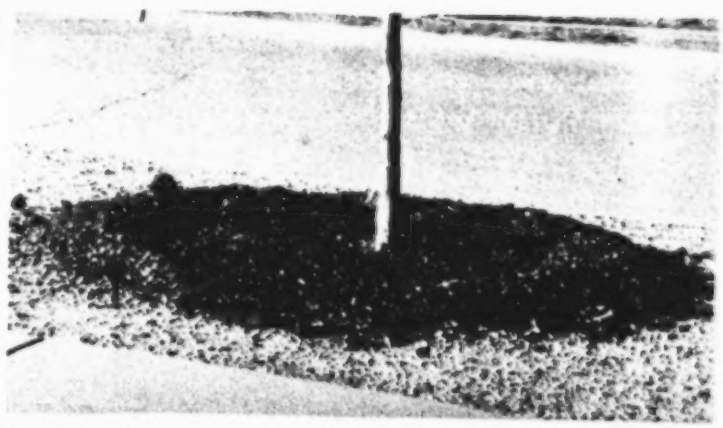

Fig. 12. A mound of earth, 3 to 4 inches high around a newly planted tree serves as the dike of a reservoir. This will hold sufficient water to soak the soil of the backfill and the soil contained in the ball about the plant roots.

Pruning. Newly planted trees should be pruned because many of the fibrous roots through which water is obtained are lost when the trees are dug. In general, removing 15-35 percent of the leaf-bearing wood to compensate for this root loss is recommended to help prevent injury or death of newly planted trees. Remove injured, weak, interfering, and poorly located branches. Entire branches should be removed, leaving the tree with a thinned out crown, one good leader, and an adequate number of well-spaced lateral branches with uncut tips (Fig. 13). Do not remove small twigs along the leader or main branches.

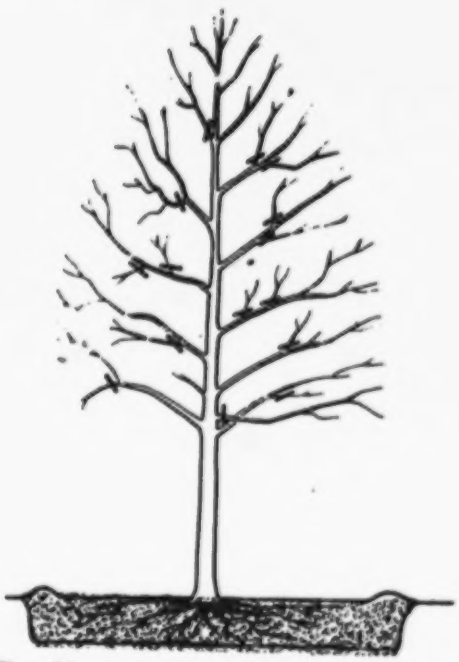

Fig. 13. The black bars on the branches indicate top growth that should be removed on newly planted trees.

3. HOW SHOULD I PROTECT THE TREE?

After planting a tree, take several precautions to protect it against wind, insect, drought, and other dangers. The following suggestions cover the most commonly required practices—bracing, wrapping, and watering.

Bracing

Most trees over 1 inch in trunk diameter must be braced with stakes or guys to hold them in an upright position and prevent loosening of the soil around the base of the trunk and drying out of the roots. Such bracing is usually required during the first year. One or two stakes are adequate for bracing trees less than 3 inches in trunk diameter. Trees can be braced with 2 x 2 or similar wood stakes, with light metal posts or with guys (Fig. 14). Either two stakes placed on opposite sides of a tree, or one stake or metal post placed on the side of the prevailing winds (1 foot or so away from the tree and driven into the ground 2 or 3 feet), may be used. To avoid injuring the tree roots, set the stakes before the roots are covered with soil.

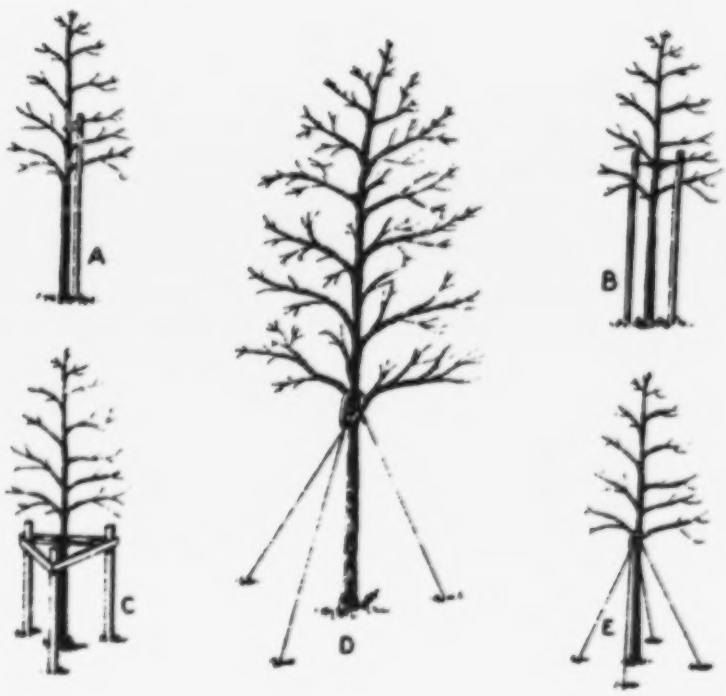

Fig. 14. Methods of staking and guying young trees. (A). Single stake, (B). Double stakes, (C). Triple stakes, (D). Three-way guys, and (E). Four-way guys (courtesy National Park Service).

Attach the tree to a stake with a soft rope or wire run through a piece of hose (Fig. 15 and 16) or other suitable material to avoid injury to the trunk. If the wire encircles the trunk without such protection, it will girdle

Fig. 15. Metal posts are strong and durable, and may be used repeatedly for bracing newly planted trees.

Fig. 16. A single guy or wire is sometimes used for bracing small trees. Attach the guy to the tree through a piece of hose that encircles the trunk at a crotch and fasten the other end to a stake placed several feet from the tree.

the trunk and is likely to kill the tree (Fig. 17). Cross or "figure eight" the rope, or twist the wire between the stake and the tree, to prevent chafing of the bark.

Fig. 17. Bare guys or wires that encircle the trunk and that are too tight or left on too long will girdle the trunk. Such girdling frequently prevents enlarging of the trunk below the girdle as shown here.

Trees more than 3 inches in trunk diameter need three stakes or three or four guys for adequate bracing. To brace with three stakes, place the stakes at equal intervals around the tree and 1 foot from the trunk. Brace the stakes with cleats, attached 4 to 6 inches below the tops of the stakes, to form a triangular structure connecting the three stakes. Attach the tree to the stakes with soft rope or wire as described previously. Trees planted with large balls of soil may not need bracing.

Guys for large trees consist of 3/16- to 1/4-inch, 7-strand cable, or two strands of No. 9, or four strands of No. 10 or No. 12 galvanized steel wire, twisted. Attach the guys to the tree through pieces of hose that encircle the trunk at a crotch or through lag hooks equally spaced around the trunk. Place the lag hooks 8 or 10 inches apart to avoid weakening of the trunk, and in line with the deadmen (anchor pieces) to which they will be attached. Locate the deadmen, which may be 4- by 6-inch pieces of timber 4 feet long buried to a depth of 4 feet, or other suitable anchor materials, at a distance from the tree so that the guys will be at a 45-degree angle when twisted taut. In clay and nonrocky soils, wing anchors 30 inches long or longer can be used in place of deadmen. Examine the guys at regular intervals to see that they are taut and that they are not injuring the trunk.

Wrapping

Protect the trunks of newly planted trees that have smooth bark from sunscald, drying, and borer attacks by wrapping them with special tree-wrapping crepe paper, Kraft wrapping paper of at least 40-pound weight, burlap, or other suitable material (Fig. 18). The trunks of trees with coarse or rough bark should be treated with DDT instead of being wrapped.

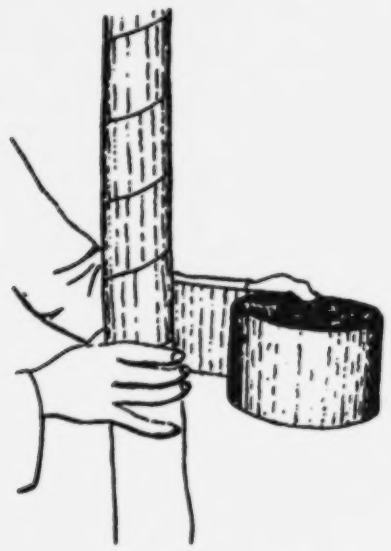

Fig. 18. Wrapping the trunks of newly planted trees protects the bark from excessive drying, sunscald, and borer injury (courtesy National Park Service).

Crepe paper reinforced with asphalt is effective in preventing borer injury. In addition to acting as a barrier, the wrapping reduces loss of water and thus prevents excessive drying of the bark. Dry bark is especially attractive to borers. As a general recommendation, keep the trees wrapped for two growing seasons or until they are growing vigorously. Remove the wrappings each spring and fall to examine the bark for insect injury. If borers are present, treatment is recommended.

Rolls of paper or burlap 3 to 8 inches wide are commonly used for spiral wrappings. Suitable widths are 3 or 4 inches for small trees, 5 or 6 inches for medium trees, and 7 or 8 inches for large trees. Burlap 4 inches wide and sewn on one edge makes a neater wrapping than unsewn or torn strips. Apply the wrapping material neatly. To wrap the trunk, start at the base of the branches and wrap spirally to the ground. Cover any bark exposed below the wrapping with soil. Secure the wrapping with raffia, string, or stout twine. The twine may be tied around the base of the wrapping with a slip knot and then wrapped, using spaced loops, as shown in Fig. 19,

Fig. 19. Tie twine securely on top of the wrapping paper to hold it in place.

or it may be wrapped spirally around the trunk in the opposite direction to the spiral of the wrapping paper. The twine is tied securely at the top of the wrapping. Examine the twine periodically and loosen it if this becomes necessary to avoid girdling the trunk.

Watering

Newly planted trees with limited root systems need an abundance of water during the growing season. Supply enough water to soak the soil around the roots at each watering, but do not water too often; allow the soil to dry sufficiently between waterings to provide adequate aeration for good root growth. A common practice is to soak the soil thoroughly every 7 to 10 days during prolonged dry periods in the growing season. Sandy soils require more water to maintain good tree growth than do loam or clay soils. You can get a rough idea of the amount of moisture present by squeezing a handful of the soil. Adequate moisture is available if the soil remains in a firm ball after it has been squeezed.

Water distribution will be more even throughout the root area if dikes, collars, or levees are made around the tree, as indicated in Fig. 12, beyond the edges of the original hole or beneath the tips of the branches, and holes are drilled to various levels in the soil within the dikes. Recently planted trees, and especially evergreens, also need an abundance of water before the ground freezes in the fall, to carry them through the winter months.

Adapted from Illinois Trees: Selection, Planting, and Care, by J. C. Carter, Illinois Natural History Survey.